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Of Our Own Making

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This civilized world is proud of the progress it has made during the last half century in what is generally referred to as science and invention. At no time in the past have such enormous forward strides been made in so short a period of time. In fact the advances of a mechanical nature have been so rapid that very few other things have kept pace, with the result that many of our social and economic ills are direct outgrowths of this progress.

The applications of physical science have yielded their rewards in profits and pleasures and will continue to do so, but unless similar advances are achieved in other fields the results threaten to prove their own undoing. Just as the greatest advances of the recent past have been physical and mechanical so those of the immediate future must be biological. It has been largely through the achievements of the life sciences that our present social existence has been able to maintain itself and a tremendous obligation rests upon society to see that it not only retains the benefits of these discoveries but makes possible the continued and rapid advance that is necessary in these fields.

Discoveries will continue to issue from the laboratories of universities and institutions of research if they are properly supported. It is a characteristic of most research workers to make known the results of their labors to a very small group of specialists in their own field. This is sufficient for a major portion of their work. But if the general public is to have a sympathetic attitude toward these activities and is to profit from their results it is essential that this general public be informed concerning these results. It is essential that the public be aware of what is true and reliable and able to distinguish between this and rank propaganda with which it is constantly belabored.

It is the business of the teachers of biological subjects to interpret science to the public and to stimulate a general interest and understanding of what prog-

* Dr. D. F. Miller has been the representative of the committee of The Union of American Biological Societies which was directly responsible for the formation of The National Association of Biology Teachers.

ress in biological research means in everyday life. It is largely within the public, private and parochial schools that we find this function can and must be performed. Thus it becomes imperative that teaching in these subjects be made adequate to the task with which it is confronted.

It is only occasionally that one meets a teacher of biology who is sure that he knows just how his subject should be taught and is satisfied that he is doing it. From teachers scattered throughout the nation comes the expression of a twofold desire. "How can we improve the quality of our own classroom teaching?" and "What can we do in our locality to improve the general status of our teachers of biological subjects?" Most of these teachers are in earnest. They are willing to make every effort toward self-improvement and are eager to cooperate with others for general progress. Then why has not more been done? The answer lies largely in the fact that there has been no definite leadership and no concrete help offered, or received when sought. In some cases they have looked to institutions of higher learning and found there only technical formalized example to follow, or high sounding verbalistic theory too abstract to be of much help. In other cases they have turned toward organizations and there they have found that the dominant elements of interest are technical research or that such a wide range of interests are intermingled that there is little chance that those peculiar to their cause could be well served.

Expression of the needs of the teachers which have come from many quarters and further expression of what is expected in the future should offer our best guide as to the course our efforts should pursue. A brief summary of these expressions might be set forth in the following statements:

1. That teachers qualified to teach biological subjects be given opportunity based upon merit as shown in their training, experience, and past success, and that this principle supersede the depression-fostered practice of employing the home town or county resident *regardless of these qualifications.*
2. That the teaching of biological subjects be done by those who are prepared to teach them, setting aside the often expressed opinion and practice that the biology class can be taken by anyone whose schedule permits if he had a general course in college. Many biology teachers were hired because of special training in other fields.
3. That teachers who find themselves teaching biological subjects without proper preparation take every possible step to get prepared.
4. That better teaching be used as the first step in attracting attention toward and favorable recognition of our field of teaching.
5. That administrative attitudes need to be changed in regard to the aforementioned points.
6. That our subject matter drop the *overload* of formal technical terminology, morphology and taxonomy with which it is sometimes burdened.
7. That subject matter be directed along lines of practical worth to the particular students of our various communities, and that it is not wise to suppose that any one choice of material, methods or point of view could be the best for all.
8. That teachers of biological subjects make special effort to keep in touch with what is being done in their fields of science; that they be *conversant* with the newer objectives in methods and techniques of measurement even though not always in *accord* with them.
9. That teachers stop taking the paths of least effort in the work of the classroom in order to make room for time-consuming duties outside of the classroom which are often

requested of them, not that some of these extra-curricular duties are not worthy but that they should not receive first consideration.

10. That much of the time so occupied be devoted to planning and executing a biological program which can be made to function vitally in the social life of the community.
11. That those interested in the teaching of biological subjects get together at regular short intervals to discuss their problems and to exchange ideas, not to bemoan the existing undesirable conditions but to encourage each other in a united effort to do something definite to improve these conditions. This should be in the nature of a program extending over a period of time with a schedule of activities.
12. That these local groups become affiliated with similar groups throughout the country thus lending support to each other and to any widespread objectives as occasion demand. That a journal be issued by these affiliated groups which shall be their mouthpiece and which shall have as its function the serving of the specific needs of teachers of biological subjects.

If the desired help, leadership and direction have not come from without then they must come from within. Realizing this the Union of American Biological Societies appointed a Committee on Biological Science Teaching to undertake the task of stimulating the teachers of biological subjects into solving their own problems. Under the leadership of Dr. Oscar Riddle of Cold Springs Harbor, Long Island, the committee formulated a plan. The first steps of this plan were as follows: 1. To form a National Association of Biology Teachers which shall consist of and exist for the welfare of those interested directly in classroom teaching. This will mean largely, though not exclusively, the teachers of the secondary schools. 2. To publish a journal which shall be devoted exclusively to the problems and needs of these teachers. This will become the unifying medium and organ of expression for the biology teachers. It must be made useful in discussing teaching problems, classroom methods, and concrete and intimate suggestions of direct interest to those who are in contact with the students. 3. To encourage the formation of *local groups* of teachers of biological subjects that will meet at regular intervals for the express purpose of discussing their classroom problems, exchanging ideas and encouraging the maintenance of the best possible local conditions for teaching in their field. The strength and substance of the committee's plan rests largely upon this third point. To whatever extent the teachers will cooperate to work out their problems and improve themselves and their teaching, to that extent will the entire movement be a success.

Points 1 and 2 of the plan are already functioning. On July 1st at an enthusiastic meeting in New York City fifteen delegates representing fifteen hundred biology teachers of the United States organized the National Association of Biology Teachers, elected officers, wrote a constitution and established the *American Biology Teacher* as their journal. From all parts of the country have come expressions of interest and enthusiasm. There are places where local organizations have existed for many years and these finding strength in their new relationship have now an opportunity to contribute much to the success of others. There are places where new and enthusiastic groups have been formed as a part of the N. A. B. T. and these are progressive organizations alive to their needs and possibilities. They are making it a point to see that the biology teachers in the more isolated county and village schools are all spe-

cially invited to become active members of their groups. They plan programs of small exhibits of student work and demonstrations of methods and techniques found useful by experience. Their meetings are always open to a free discussion and they occasionally have exchange programs with neighboring groups.

Most of these organizations plan to take active parts in their district and state association meetings to prevent these meetings from becoming a case of just listening to another lecture. Matters of professional concern are discussed and frequently acted upon.

General education is today undergoing changes that are revolutionary. New theories, objectives and practices are appearing on all sides. New things are ahead for all of us. We shall find a much modified education in the next two decades. The practices of the past may have served well in their day but that does not guarantee them for the future. Much that is new will fall by the wayside but out of the confusion will emerge a new education better fitted to the needs of its day. The present and future will be largely in our own hands and the results will be of our own making. May the next generation be able to look with satisfaction upon that which they shall inherit.

A Program of Teacher-Education in Secondary School Biology Recommended by Teachers in Service

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We are now witnessing a more widespread interest in teacher-education than we have hitherto experienced. Studies are under way which show promise of placing the teaching profession on a higher plane, comparable to that now enjoyed by the other learned professions. Those of us who are connected with institutions of higher learning, especially teacher training institutions, are particularly interested in the advancement of such a program. The type and content of subject matter to be offered to those in training, as well as the best techniques in teaching the subject, are uppermost in our minds. This brief study deals only with the training of biology teachers, and only with the type of subject matter which we might place at the disposal of those in training. Many suggestions, recommendations and studies concerning the type of courses that should be offered as a part of the training of biology teachers, may be found in the educational literature. Few of these suggested curriculum set-ups have come from classroom teachers actually engaged in the teaching of high school biology. Such suggested programs are not to be discredited however, for many of them are excellent. In addition to the programs of study suggested primarily by those engaged in educational activities at the higher levels, the writer has entertained

the idea for some time that we might obtain valuable suggestions from those who have gone through our institutions, have gone out into the field, and have had actual experience teaching high school biology. With that in mind, two questions, pertaining to the academic and professional preparation of biology teachers, were sent to 150 high school biology teachers in the State of Kansas in the Spring of 1938.[1] The two questions were as follows:

1. List the academic subjects which you consider *essential* for effective teaching of biology in the secondary schools, and

2. List the professional or educational subjects which you consider *essential* for effective teaching of biology in secondary schools.

Column I		Column II	
Academic subjects		Professional subjects	
Name of subject	Number times listed	Name of subject	Number times listed
Zoology*	87	Methods in Biology	49
Botany**	77	General Psychology	43
Human Physiology	60	Practice Teaching	30
Bacteriology	35	Educational Psychology	19
Entomology	28	Educational Measurements	14
General Biology	22	Secondary Education	10
Health and Hygiene	21	Adolescent Psychology	6
Anatomy	16	Abnormal Psychology	5
Agriculture	16	School Management	4
Genetics and Eugenics	14	Curriculum Construction	3
Embryology	13	Vocational Guidance	3
Taxonomy	10	History of Education	3
Field Biology	8	Principles of Education	2
Ornithology	8	Educational Statistics	2
Ecology	8	Educational Sociology	1
Nature Study	5	Visual Aids	1
Histology	5		
Microtechnic	5		
History of Biology	2		
Parasitology	2		
Foods	2		
Social Biology	1		
Paleontology	1		
Pathology	1		
Other Subjects			
Chemistry	38		
Geology	9		
Physics	5		

Academic and professional subjects considered essential in the training of biology teachers at the secondary school level, by 107 high school biology teachers in the State of Kansas.

* Includes general, invertebrate and vertebrate zoology.

** Includes all divisions of the subject as listed.

[1] I am indebted to Mr. Don Gooden, a graduate student at the Kansas State Teachers College, who was kind enough to include these questions on a questionnaire he used in connection with his Master's thesis.

Of the 150 questionnaires sent out, 107 were promptly returned. The questionnaires were sent to teachers in every section of the state, and replies were received from teachers who had doubtless had their training in the various educational institutions in Kansas, as well as other states, and from those with quite varied problems as far as their own individual situations were concerned. It must be remembered, especially in Kansas, that the type of biology courses given in the state, vary a greta deal depending on the locality of the school. The flora and fauna in the eastern and western portions of the state differ markedly. A majority of replies were, however, from teachers in the central and eastern portions of the state. The results of the questionnaires are given in the accompanying table. It is not the writer's intention to elaborate very much on these tabulations, but to give them for what they might be worth as a contribution from those teachers in service who have been kind enough to answer the questionnaires. Judging from the fairly good percentage returned, and their prompt replies, it would seem to indicate that these are questions in which teachers themselves are interested.

Academic Preparation

Column I in the accompanying table shows the academic subjects listed in order of their occurrence on the questionnaires. It is at once apparent that the majority of teachers in service recognize the importance in their training, first of all, of the fundamental biological subjects —zoology, botany and human physiology. In the place of zoology and botany, 22 of those answering the questionnaire, would substitute a course in general biology. Such subjects as bacteriology, entomology, health and hygiene would occupy a rather prominent place in their program. It appears to the writer that some of the subjects listed are really not essential in the training of high school biology teachers, although of value. However, these more specialized subjects—as anatomy and embryology—when listed, were given in addition to the more general courses. On the other hand, it was expected, that taxonomy, for example, would have occupied a somewhat more prominent place than indicated. However, much of the nomenclature and classification of plants and animals might be obtained from courses like general biology, botany and zoology, and more especially in entomology, ornithology, field biology, ecology and nature study, most of which were rather prominently listed. Genetics and eugenics might also occupy a more prominent place on their program. In addition to the biological sciences, many of the teachers in service recognize the value of the chemical and physical sciences as a part of their training program, and have voluntarily listed them also. (See table.) The writer finds in surveying a number of suggested programs that these recommendations, in the main, correspond quite favorably with those proposed by subject-matter specialists. Of course, it is apparent that no teacher in training could take all the subjects listed in his undergraduate training.

Professional and Educational Subjects

The group of teachers did not reply so freely to the question pertaining to the professional and educational subjects as they did to the one pertaining to the academic subjects. However, a glance at the accompanying table (Column II) will show their reaction to this question. However, it is apparent that many recognize the value of professional training in

(Continued on page 35)

Osmotic Forces in Living Organisms

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I

We are all familiar with the fact that a gas set free in a room is soon equally distributed throughout the room. This will occur even in the absence of temperature differences or draughts in any part of the room. Similarly if a crystal of a soluble salt is placed at the bottom of a cylinder of water, the salt molecules will distribute themselves equally throughout the cylinder even in the absence of any mechanical agitation. This movement of molecules (or ions) from a region of high to one of low concentration is referred to as diffusion—a process upon which the life of every cell depends every moment of its existence. All the substances required by the cell are brought to it by diffusion. The distribution of these materials within the cell as well as the elimination of waste products and poisonous substances depend primarily upon diffusion processes.

This phenomenon of diffusion is a necessary consequence of the kinetic theory of gases which states that all gases are composed of perfectly elastic molecules which move continually in a straight line until they collide with each other or with some solid object, this collision resulting in a change in direction but not in the velocity of movement. This ceaseless bombardment of the walls of the vessel containing the gas constitutes the gas pressure. The mean kinetic energy of these molecules is referred to as the absolute temperature, the higher this kinetic energy the higher the absolute temperature. This perpetual molecular motion theoretically should disappear at a temperature of absolute zero (−273° C.), such a temperature never having been attained by man.

In a liquid the molecules are much closer together and are therefore more influenced by their mutual attraction forces. Consequently, the rate of diffusion in liquids is slower than in gases, but the fundamental gas laws apply just as well. In the case of solutions (a homogenous mixture of different kinds of molecules in a liquid state) the total pressure of each species of molecule is referred to as concentration.

To generalize further, diffusion is a consequence of the second law of thermodynamics or the law of entropy. This law states that energy tends to become uniformly distributed in the universe and, therefore, tends to lose the capacity to do work, *i.e.*, entropy (uniform distribution) tends to increase. This is one of the most fundamental and incontrovertible universal generalizations. Familiar examples of this law can be seen in the flow of heat to a cooler body, the running down of a battery in an open circuit, and the processes of diffusion.

Now it is well known that diffusion is a rather slow process when large distances are considered. For example, it would take more than one hundred years for a sugar molecule to diffuse from one end of the human body to the other end. For an animal ten times as long as man this process would require ten thousand years, since the time of diffusion increases as the square of the distance. Such long-distance transportation is, therefore, accomplished by various types of mechanical circulatory systems. How-

ever, the transport of substances to and from the circulatory system, as well as intracellular distribution must depend on diffusion processes which, because of the same square law, are extremely rapid when small distances are considered. For example, the same sugar molecule which would require one hundred years to traverse the length of the human body (1.5 meters) would cover a distance of 1.5 microns* (the diameter of some bacteria) in approximately 0.003 of a second. So that for distances involved in inter- and intra-cellular transportation diffusion is a much more rapid process than the mechanical transportation by circulation.

Another consequence of the diffusion laws was pointed out by Prof. M. H. Jacobs (1931) whose brilliant and extensive investigations constitute the most outstanding contribution to our understanding of the problems of cell permeability. Since diffusion is a process of dispersion leading to a uniform distribution of substances, it is, therefore, "the greatest enemy of living matter" which depends primarily on the process of segregation and organization of substances. In fact, the fundamental problem of vital processes is to keep diffusion from accomplishing its inevitable task, *i.e.*, disorganization and uniform distribution—a phenomenon which we refer to as death. This task is accomplished by living organisms by the elaboration and maintenance of membranes possessing specific permeability properties which are characteristic of different types of cells. Indeed, a change in cell permeability constitutes one of the most delicate tests of cell viability, as has been beautifully demonstrated by the recent work of Lucké and McCutcheon (1932) and many other workers.

If, instead of permitting sugar molecules (termed solute) to diffuse freely to a supernatant layer of water (solvent), we interpose between the sugar solution and the water a membrane possessing pores which are large enough to permit the passage of both the water and the sugar molecules, diffusion will proceed just the same except that the rate will be decreased. So that the presence of such a membrane presents no new principle. If, however, we use, for example, a collodion membrane, whose pores are large enough to permit the passage of water molecules but not of sugar molecules (semipermeable membrane), the concentration of water in the water compartment is greater than on the side of the membrane containing the sugar solution; water will, therefore, diffuse into the sugar solution until the concentration of water on both sides will be equal. Such a differential diffusion of water through a semipermeable membrane is called osmosis. Since the membrane is completely impermeable to sugar, the concentration of water on both sides of the membrane can never become equal and all the water should therefore diffuse to the sugar compartment. However, the hydrostatic pressure of the accumulating column of liquid finally opposes further diffusion and the system is said to have reached a state of equilibrium. This hydrostatic pressure is referred to as osmotic pressure. Its magnitude is directly proportional to the difference in concentration between the two liquids. If we attach a movable piston at the upper layer of the sugar solution and apply pressure equivalent to the hydrostatic pressure referred to above, osmosis will be prevented. In other words, osmotic pressure is the pressure which must be applied to a solution confined by a semipermeable membrane in order to prevent the entrance of water.

* One micron equals 0.001 mm.

If, instead of cane sugar, we use glucose or some other small molecule which can traverse the membrane, the water molecules, being smaller, will diffuse more rapidly into the sugar compartment since the diffusion rate is inversely proportional to molecular size. This will develop a certain hydrostatic pressure which will be less than the pressure it could develop if the membrane were completely impermeable to the solute. Moreover, after some time all the glucose molecules will be equally distributed on both sides of the membrane and the hydrostatic pressure will disappear. It follows that the full osmotic pressure of a solution is exhibited only in the presence of a completely semipermeable membrane.

The semipermeability of a membrane need not always be due to the presence of pores of certain magnitude. Differential solubility of the solvent in the membrane will produce the same results. For example, if we tie a rubber membrane around a thistle tube, fill it with a solution of sugar in pyridine, and place it in a vessel containing pyridine, the latter, being soluble in rubber, will pass through the membrane while the sugar, being insoluble in rubber, will be confined to one compartment. It is then possible to measure the osmotic pressure of sugar by this set up. The semipermeable properties of membranes of living cells are probably determined both by the presence of pores and by differential solubility.

Though it may sound paradoxical, osmosis may occur in the absence of any membrane or of any direct contact between the solutions. If we place two beakers, each containing a sugar solution of different concentration into a hermetically sealed container, we will find that after some time the level in the dilute solution will decrease while it will increase by an equivalent amount in the concentrated solution until the concentrations in both beakers will be equal. The quantity of water transferred from one beaker to the other will be proportional to the difference in concentration between the two solutions and will be of the same order of magnitude as would occur if the solutions were separated by a completely semipermeable membrane.

What is the explanation of this phenomenon? We are all familiar with the fact that water as well as other fluids tend to evaporate when exposed to air. This is because the water molecules at the water-air interphase have a certain escaping tendency due to their kinetic energy. This is often referred to as vapor pressure and its magnitude is characteristic for different fluids, being, naturally, higher at higher temperatures. A similar escaping tendency exists at the boundary of any two phases (*e.g.*, ice-water interphase) or between two solutions separated either by their immiscibility (*e.g.*, water-oil interphase) or by a membrane.

When a non-volatile solute (*e.g.*, sugar) is dissolved in a solvent, the concentration of the solvent molecules at the interphase (as well as in the interior of the solution) is lowered and the escaping tendency is therefore decreased. The water molecules will therefore accumulate in the beaker where this escaping tendency is lowered. We may, then, redefine osmosis as the movement of solvent from a region where its escaping tendency is high to a region where this escaping tendency is low. Osmotic pressure may then be defined as the pressure necessary to apply to a solution in order to make the escaping tendency of its solvent molecules equal to that of the pure solvent.

It is evident from the previous discussion that the addition of a solute should

decrease the boiling point of a solution since the boiling point is the temperature at which the vapor pressure of a liquid equals to the atmospheric pressure. Since foreign molecules lower the vapor pressure, the solution will have to be heated to a higher temperature in order to raise the vapor pressure to the value of the atmospheric pressure. This is indeed the case. By a similar method of reasoning, it can be deduced that solute molecules should lower the freezing point of solutions. This is the basis for antifreeze solutions in car radiators during the winter months. Usually ethylene glycol or glycerol are added to the water so as to lower its freezing point.

It is obvious by this time that the effects of solute molecules on vapor pressure, freezing and boiling points, and osmotic pressure are somehow related. They are, therefore, referred to as colligative properties of solutions (from the Latin, colligate—to bring together under one conception). They all depend entirely on the number of solute molecules added, the kind of molecules added being of no importance. The electrolytes behave somewhat differently and will be discussed later. So that the addition of sucrose, glycerol, glycine or any other solute will have the same effect on the colligative properties of the solution provided the same number of molecules is added.

Can we predict the osmotic pressure of any given solution? Let us recall Avogadro's law which states that equal volumes of gases at normal temperature and pressure (0° C. and 760 mm. Hg) contain equal numbers of molecules. It was shown by van't Hoff (1885) that the classical gas laws are applicable to solutions. He also demonstrated that the osmotic pressure of a solute is equal to the pressure that substance would exert if it existed in the gaseous state and compressed into its present volume. Now one gram-molecular weight of a gas at NTP occupies 22.4 L. Therefore, one molal solution (one gm. mol. wt. of solute dissolved in one L. of water) will have an osmotic pressure of 22.4 atmospheres, since it was compressed from 22.4 L. to one L. Since one atmosphere equals 760 mm. Hg, one molal solution will have an osmotic pressure of 22.4 times 760 which equals to 16.7 meters Hg, *i.e.*, it will support such a column of mercury. It was found that the same concentration of solute will lower the freezing point of water by 1.86° C. and the vapor pressure by 25 mm. Hg; it will also raise the boiling point by 0.52°. Therefore, knowing any of these values, we can calculate all the others. In fact, the freezing point and the vapor pressure methods are most commonly used now in determining the osmotic pressure of various body fluids.

In order to appreciate the remarkably high values osmotic pressure may attain in living organisms, let us recall that the total concentration of human blood is equivalent to approximately 0.3 molal of sucrose. This would exert an osmotic pressure of (0.3 times 22.4) about seven atmospheres. Compare this with the fact that the pressure within an average locomotive is only about ten atmospheres.

The subject may be summarized at this point by a short historical review. It was Abbe Nollet who first discovered osmosis in 1748, but this work was forgotten until it was rediscovered by Dutrochet (1826–37) who also observed the bursting of spore capsules when placed in water. Nagelli (1849–54) discovered that the protoplast (the thin protoplasmic layer) of plant cells would shrink away from the semi-rigid cellulose wall when the cells were placed in a hypertonic solution (a solution having an os-

motic pressure higher than that of the cell). He called this plasmolysis and correctly ascribed it to the semipermeable character of the plasma membrane (the cellulose cell wall is freely permeable to both solute and solvent). Pfeffer (1877) and deVries (1882–84) made more extensive studies of plasmolysis. Van't Hoff (1877–85) first discovered that the classical gas laws can be applied to these studies. He, as well as deVries, discovered that the osmotic pressure of salts, acids, and bases (electrolytes) was higher than that of equivalent molecular concentrations of such substances as sugar (non-electrolytes). These botanical observations stimulated the chemist Arrhenius (1887) to formulate his famous theory of electrolytic dissociation which formed the foundation of the modern science of electrochemistry.

Briefly, the data of van't Hoff and deVries indicated that salts like NaCl exerted an osmotic pressure approximately twice that of an equimolecular concentration of sucrose. Arrhenius observed that salts will also conduct an electric current, whereas substances like sugar will not do so. He, therefore, postulated that each molecule of a salt dissociated into two electrically charged particles referred to as ions. Thus, NaCl will dissociate into a positive ion Na^+ (cation) and a negative ion Cl^- (anion). It is these ions that are responsible for the electrical conductivity and for the abnormally high osmotic pressure of electrolyte solutions. Since each ion acts osmotically as a molecule the osmotic pressure of electrolytes is, therefore, proportional not to the molecular but to the ionic concentration. If a salt dissociates into three ions (*e.g.*, $CaCl_2 = 1Ca^+ + 2Cl^-$) its osmotic pressure will be approximately three times as high as its molecular concentration would indicate.

What rôle do all these phenomena play in the life processes of cells and in the organism as a whole? Even a short discussion of this would exceed the limits of this paper. It will therefore have to be relegated to another article.

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TEACHER EDUCATION

(Continued from page 30)

addition to their academic training—methods in the teaching of biology, general psychology and supervised practice teaching occupying the more prominent places in their program. (These teachers recognize general psychology as a professional subject.)

This brief survey appears to be one more indication that the two extreme schools of thought are vanishing, namely, those who hold the view that if one knows a subject he can teach it effectively without knowing teaching methods; and secondly, those who believe that if one knows teaching methods he can effectively teach the subject even though his grasp of the subject-matter is meager. Both ideas, of course, are absurd. The results here tabulated of the replies of high school biology teachers in service, indicate a middle course, and a much saner one—teachers should be well trained in *what* they intend to teach, and also in the best methods as to *how* to teach the subject.

Editorial Comment

A STIMULUS FOR CLUB GROWTH

I have before me a widely read text on science teaching recently published. Nowhere in this book is any mention made of the science club and its relation to science teaching. Such indifference to this important phase of science teaching in the secondary schools is still too widespread. Why? No teacher of biology who has ever conducted a successful biology club has ever doubted the educational values of such work to the student as well as to the teacher.

For the past ten years the American Institute has conducted an experiment in youth education which has centered around the club idea. They restricted their work to the schools of New York City. Their relationship to the school clubs was similar to that of a faculty advisor to the club itself. They stood ready to assist and guide whenever they were asked. Their program was restricted to those activities which would encourage and assist the development of clubs. The schools continued without any interference to conduct their own clubs in their own way. In this rôle the American Institute has been responsible for a considerable part of the growth in the numbers of clubs in New York City and in the enthusiasm of club sponsors and members.

Most of the attention and efforts of the American Institute has been devoted to the development of a cooperative spirit between clubs of different schools and of the clubs of the city as a whole. The efficacy of their work each year is demonstrated in the science student congress and the science fair which are looked forward to by the teachers, the public and the students with enthusiasm. At the science fair hundreds of student projects are displayed. Most of the schools participate. The spacious hall of the American Museum of Natural History where the fair is held is filled to overflowing during the week in which the fair is held. We can safely say that these cooperative endeavors have been responsible in a large part for the phenomenal growth of the club idea in New York City during the last ten years.

Credit for the success of this program must go to the teachers who have given freely of their time and experience. During the last two years under the inspirational leadership of Paul B. Mann, chairman of the Junior Science Activities Committee of The American Institute, the idea of cooperating science clubs has achieved a success that commands our attention. With the help of these school people the idea that clubs over a large area could cooperate took hold.

At present the American Institute plans to organize the science clubs on a nation-wide basis. The program is a big one. It will require tremendous efforts and skillful leadership. But whatever the price, we who have worked with the American Institute in their ten year experiment, know that the results will be well worth the investments. The Institute reports that it has been flooded with demands for the extension of its work with junior science clubs. We are glad to hear that their plans have been completed and they are ready to embark on their nation-wide project. We are enthusiastic about this extension of the American Institute program because in it we see the inspiration for the finest type of science instruction.

I. A. H.

The First Annual Association Meeting, Richmond, Virginia

M. C. LICHTENWALTER

At our organization meeting in New York City in July it was tentatively agreed there should be an executive board meeting during the holidays. This meeting was to be held concurrently with the AAAS meetings in Richmond, Virginia. Several of the executive board members have indicated they will attend this meeting.

Local biology teacher organizations interested in affiliating with the national association may if they desire send a delegate to this executive board meeting. This would offer an excellent opportunity for the local chapters to become acquainted with each other and the national officers. It would also be an excellent means for the national association to learn the desires of the local chapters. These delegates will be permitted to propose and present topics for consideration by the board and they will be permitted to participate in discussions. The only restriction will be that they will not be permitted to vote with the board.

Shall there be a program for interested members conjointly with this executive board meeting? This question must be decided soon. If there is a sufficient number of members interested; a program will be prepared and given in conjunction with the board meeting. The program, if it is to be given, would consist of a morning session, an afternoon session, an evening dinner, followed by the executive board meeting the next morning. In the event sufficient interest was shown it might be expanded into a two day program with the executive session serving as one of the four sessions.

The December issue of the journal will contain the decision of the board concerning this program. If one is to be offered the program schedule will appear together with points regarding local arrangements.

Those definitely interested in attending should do two things. First, they should communicate with Mr. George W. Jeffers, first vice-president of this association located at State Teachers College, Farmville, Virginia, for housing accommodations if they intend to stay in Richmond one or more nights. Second, they should communicate with the secretary-treasurer regarding the type of program they desire and the number of sessions they would care to attend.

Any person desiring to read a paper or appear on the program should communicate with Malcolm D. Campbell, president-elect of this association, located at Dorchester High School for Boys, Boston, Massachusetts. These individuals should send Mr. Campbell a brief of their paper, with its approximate reading time, their institution connections, degrees and any other informative pertinent data.

ADVANCE NOTICE

The National Association of Biology Teachers will establish headquarters in connection with the annual meeting at Richmond at The William Byrd Hotel. The executive committee will hold a meeting on Tuesday, December 27, at 2 P. M. Membership meetings have been planned for the morning and afternoon of Wednesday, December 28. Further details will be published in the December issue of The American Biology Teacher.

Pedagogical Briefs

Barss, H. P. and Rand, F. V.
Biological Abstracts and Science Teaching.
School and Society, 48: 182–183; Aug. 6, 1938.

The use of "Biological Abstracts" in the classrooms of colleges and secondary schools as a source of material for reports on recent advances in the biological sciences is urged. The journal is a veritable gold mine of information on the latest work done in all branches of Biology. [This publication abstracts original research articles which have appeared in all of the available journals in America and abroad. The cost of publication is necessarily high, but it is of extreme value to research workers and others interested in specific fields.—Ed.]

Fried, A. A.
Of the Pupil, by the Pupil, for the Pupil.
High Points, 20: 31–40; June, 1938.

Valuable suggestions on review technique are offered in this paper. The author, a teacher at Evander Childs High School, New York City, has developed a novel procedure in which the pupils conduct the review by quizzing each other. Success for the method is claimed because it motivates what might otherwise be an extremely boring part of the classwork.

Leibson, B.
How the Study of Biology Helps the Student Understand Modern Social Problems.
School and Society, 48: 356–360; Sept. 17, 1938.

This is a very able discussion of the part Biology can play in educating the future citizen. Using as examples the relation of the subject to community health, labor problems, and similar social conditions, Mr. Leibson urges a closer correlation between the work of the classroom and the conditions which the student will meet in later life. A background of scientific facts coupled with a training in the scientific method will do much toward aiding the student in threading his way through the intricate maze of modern society.

Schellhammer, F. M.
Facts and the Teaching of Biology.
School and Society, 48: 242–243; Aug. 20, 1938.

The relation of facts to the teaching of Biology is that of illustrative matter which can be brought to the enrichment of the course. The writer contends that "though we may use facts, we must, in our teaching, develop an understanding of and an ability to use the methods of science in the understanding of the basic principles of civilization."

Stoddard, S. E.
Genetics and Eugenics in Secondary Schools.
School and Society, 48: 245–249; Aug. 20, 1938.

Due to the great strides made by the subject of Genetics during the past three decades, the time is now ripe to discuss with our high school seniors the human application of these principles. Such training is undoubtedly essential to successful living and should play an important rôle in our biology curriculum. Mr. Stoddard advances some sound points in favor of his thesis and anticipates some of the arguments which may be raised against it. He has included an annotated outline of the course he is now giving in the High School of Blackfoot, Idaho.

Biology Teaching Aids

PHOTOSYNTHESIS

The writer cannot credit the originator of this experiment, since the source of the method is not known. Through some years of experience, variations have been introduced to meet environmental laboratory needs. Possibly as the reader tries it out, changes will recommend themselves, producing a greater degree of efficiency.

To Prove that Oxygen is Liberated during Photosynthesis

A two liter Erlenmeyer flask is filled with tap water. Carbon dioxide gas is run into this water, using as a source solid carbon dioxide or a generator, until saturation is reached. If a carbonate-acid generator is used, sulphuric is to be preferred to hydrochloric acid, since hydrogen chloride gas might escape into the water in the flask and be liberated during photosynthesis. Some degree of care must be used that the water does not become oversaturated, since carbon dioxide will be liberated and in quantities sufficient to "drown out" the oxygen. Using a generator with rapid even evolution of carbon dioxide, about two minutes is sufficient for saturation. In other words, enough gas must be introduced to supply carbon dioxide for carbohydrate making in the leaf, leaving no surplus to escape from the water and mix with the oxygen from the leaves during the process. Only the first test tube of oxygen, of course, might be contaminated.

Large blade healthy leaves are placed carefully into the saturated water, throughout the height of the flask, with the heavier chlorophyll bearing surface flattened outward to get all the sunlight possible. Such leaves as Swiss chard, spinach, or even beet leaves, from the market have been successfully used.

A one-hole rubber stopper containing a six-inch glass funnel with stem extending through the stopper and not below the stopper, is screwed tightly into the flask. The funnel is filled about two-thirds with tap water.

A test tube, six or eight inch, is filled with tap water and inverted in the funnel so that the mouth of the tube rests on the stem of the funnel and no air bubbles are present in the tube. The latter is held in place by a square or circular piece of glass or cardboard, with a center opening large enough to admit the test tube. The square rests on the edge of the funnel.

The set-up is then placed in direct sunlight. The rapidity of the evolution of oxygen will depend upon the chlorophyll and carbon dioxide supplies, as well as upon the intensity of sunlight. A test tube of oxygen has been collected within a half hour when the apparatus was placed out-of-doors in a summer sun. Half a day may be necessary in fall, winter, or spring, if the flask is placed on the laboratory window sill in the sunlight. The test tube should be full of oxygen, if possible, before removing it from the funnel, by placing the thumb over the mouth of the tube.

The apparatus is sufficiently large so that the flare of the glowing splint placed within the mouth of the test tube may be easily seen by a large class and the rise of bubbles throughout the liquid in the flask, as well as the displacement of water from the test tube, may be observed.

The experiment, with accompanying teaching, has invariably proved convincing to the student.

Eva B. Ammidon
Teachers College, Boston

A NEST OF HORNETS FOR YOUR LABORATORY

An old hornets' nest that had been brought into the laboratory created so much interest that it was decided to get a nest full of live hornets if possible.

The project was explained briefly in all classes and students were asked to be on the look-out for one that we could collect. Within a few days one boy reported that he had located one in a hog-lot near his home.

That afternoon armed with a long window pole, a handful of cotton, some, string, about ten yards of mosquito netting and a can of ether the writer and two students started out on the collecting trip.

Arriving on location the mosquito netting was doubled and cautiously placed on the ground under the nest. The cotton was tied on the end of the pole but as the window pole seemed too short for safety it was discarded for a pole about twelve feet long that was found nearby. The cotton was tied to the end of the pole and soaked with ether. From behind a convenient tree the ether soaked cotton wad was placed over the opening to the nest for about five minutes. During that time about two dozen workers came in from the fields and circled about the nest. The cotton wad was swung away permitting the returned workers to enter the nest. The supply of ether on the cotton was replenished and the wad returned to the opening of the nest for another application.

When all seemed quiet the twig on which the nest was built was broken with the pole permitting the nest to drop to the mosquito netting below. The edges of the netting were quickly gathered above the nest and securely tied. The capture had been made! Just as we were leaving the location a lone late-returning hornet "found" one of the students and stung him on the forehead. This was the only casuality on our side.

On the return trip the nest was held out of a window of the car. Upon our arrival at the laboratory the hornets had all revived and gave every evidence of being quite unhappy and considerably disturbed. In the laboratory the fastener on the netting was removed and the entire package was placed in a large glass jar with a plate glass cover. With a hooked wire one edge of the netting was pulled out under the cover. Slowly the entire piece of netting was pulled out under the cover leaving the nest and captives in the jar. A piece of screen wire was slipped under the plate glass and securely fastened around the edges permitting the removal of the glass cover.

During the entire process of transfer perhaps a dozen and a half of the hornets escaped into the laboratory. To our surprise and pleasure they immediately sought the tops of the south windows where they were easily captured with nets.

After two days of exhibition, during which time most of the students in the school visited the biology laboratory, the colony was killed with chloroform.

Opening the nest the class studied its construction, counted the adults, examined the immature stages and noted the other insects present.

In case any teacher cares to try this project it would be well to add to the equipment list a long-handled pruning saw to cut the limb on which the nest is built.

Doubtless a series of fortunate circumstances contributed to the success of the project.

P. K. Houdek
Township High School

News and Notes

Of Local Organizations

THE GREATER CLEVELAND ASSOCIATION OF BIOLOGY TEACHERS

The biology teachers of Greater Cleveland organized a Chapter of the National Association of Biology Teachers on May 17, 1938, under the able direction of Dr. D. F. Miller, of Ohio State University. At that time the following officers were elected:

President: James C. Adell, School Headquarters, Cleveland.
Vice-President: Miss Edith I. Scribner, Shaw High School, East Cleveland.
Secretary: Miss Villa B. Smith, John Hay High School, Cleveland.
Treasurer: John Richards, West Technical High School, Cleveland.

The program for the year 1938–1939 is in the hands of a capable committee consisting of:

Ellis C. Persing, West Technical High School, Cleveland.
Dr. Everett C. Myers, High School, Shaker Heights.
Miss Nell Henry, Glenville High School, Cleveland.
Miss Helen Miller, Hazeldell School, Cleveland.

A trip to the Hinkley Reservation of the Metropolitan Park Sytem was conducted mid-October. A laboratory demonstration has been announced for early December. In September a joint meeting with the Cleveland Natural Science Club attracted many members to the Science Club Lodge where Dr. H. N. Wheeler, Chief Lecturer, U. S. Forest Service, presented an illustrated lecture, "The Lure of the Forest."

VILLA B. SMITH,
Secretary.

KANSAS ASSOCIATION OF BIOLOGY TEACHERS

Within the last few months the Kansas Association of Biology Teachers has been organized and has affiliated with the National Association. Mr. O. P. Dellinger has been elected president, L. D. Wooster, vice-president, and Gladys Beck, secretary-treasurer. Plans will be made to have representation of the newly formed association at each section of The Kansas State Teachers Association meeting to be held in November, 1938. A meeting of the biology teachers association is scheduled for the Saturday of the week during which the State Teachers Association will meet. Further details will be published at a later date.

O. P. DELLINGER,
Kansas State Teachers College,
Pittsburg, Kansas.

DUES NOW PAYABLE

Pledged members of The National Association of Biology Teachers may pay their dues to a local, state, or regional representative. Any member may, if it is more convenient, remit dues to Mr. P. K. Houdek, Township High School, Robinson, Illinois.

It is extremely important at this early stage in the life of the association that those who have pledged their membership support the activities of the association by paying their dues immediately.

In some cases dues and memberships have passed through three or four hands before reaching the secretary-treasurer. Any member who does not receive a membership card within a reasonable time after transmitting dues should communicate with the secretary-treasurer, Mr. P. K. Houdek, Township High School, Robinson, Illinois, giving the date dues were paid and to whom they were paid.

The Use of Objects, Specimens, and Models in the Teaching of Science

ELWOOD D. HEISS
Head of Science, State Teachers College, East Stroudsburg, Pa.

A good science teacher makes provision for pupils to see and handle materials at the right time. Effective teaching requires the choosing of the right details and the seizing of the psychological moment to make these materials stand out and serve in the process of instruction. Effective teaching stimulates a spirit of inquiry and industry in pupils and arouses in them a desire to solve problems and to achieve results.

Objects, specimens, and models offer exceptional opportunities to the resourceful science teacher. In fact it is very doubtful whether effective science teaching can be achieved without a liberal use of these visual aids.

Objects. An object is the thing itself—for example, a bird, a frog, a grasshopper, a flower, a barometer, and many other things which may be brought into the science classroom and laboratory for study.

Objects are ideal visual aids. They are the things themselves; they are reality and not a substitute for reality. Objects are preferred in science teaching whenever it is possible to obtain them because they put the pupil in direct contact with actual things and relationships. They provide the means for establishing correct initial concepts in the minds of the pupils.

Specimens. A specimen is a sample or a part of an object—for example, a piece of coal, a piece of marble, the skin of a bird, a leaf, or a piece of mineral. Depending upon how it is used in teaching, a thing may be an object or a specimen. An actual monarch butterfly if it were used by a biology teacher to represent all butterflies would be a specimen. However, if the monarch butterfly were used to study only the characteristics of the monarch butterfly it should then be classified as an object.

Specimens are excellent visual aids for science teaching but they are not quite as valuable as objects. Since they are only a sample or a part of an object they cannot stimulate as complete a sensory experience as objects do.

Models. A model is a replica of something. It may be a representation in miniature—for example, a small model of the working parts of an automobile such as is now used by many general science and physics teachers, or it may be a representation in enlargement such as a model of a paramoecium or a model of a hydra.

Models are very helpful to science teachers, but they also have their limitations. Models generally are not true in size or color. If a biology teacher employs a model of a paramoecium incorrect concepts may be formed in the minds of the pupils about the paramoecium unless provision is made in some way to overcome the psychological limitations of the model.

Museums. One of the chief aims of science teaching is to make children intimately acquainted with the nature of the world in which they live; to teach them to understand and appreciate the interrelationship between man and his environment. Children cannot gain such

appreciation and understanding of their surroundings by merely reading about things; it must come through observation and handling of things.

Observing things and phenomena in their natural setting is the ideal way to gain knowledge. However, with our present system of mass education this is not always possible or feasible. It becomes exceedingly important then that we bring the outside world into the classroom and laboratory through exhibits and other concrete representations of things.

The science department of every school should begin a museum. There is a wealth of material within the reach of nearly every school. The natural instinct for collecting and hoarding which many children seem to have should be utilized for building up the museum as well as for motivating and vitalizing the subject matter of science courses.

The following list of topics is indicative of the great variety of specimens and objects from our world of living things which may be collected for the school museum: butterflies, moths, other adult insects, frogs, toads, snakes, turtles, salamanders, various other types of animals, eggs of frogs, toads and salamanders; birds nests, cocoons, larvae of insects, leaves, stems, fruits, roots, grasses, flowers, bark, tubers, bulbs, corms, mushrooms, lichens, and seeds.

Other sources of museum materials are as follows:

1. *Museums.* Science teachers should investigate nearby museums to determine whether any exhibits or specimens may be borrowed, rented, bought or obtained for keeping free of charge. Exhibits of raw materials such as latex, flax, wool, silk, cotton, and food stuffs may be obtained at a low cost from the Commercial Museum, Philadelphia.

2. *Homes.* Teachers should encourage pupils to bring things from home which will serve to illustrate lessons. Household utensils, gadgets of various kinds, pictorial materials, books, etc., useful for a museum may be obtained in this way.

3. *Local Stores, and Industries.* Excellent museum materials may sometimes be obtained free from local stores and local industries or purchased at a low cost from stores such as five and ten cent stores.

4. *Butcher shops and slaughter houses.* These are good places for biology teachers to find anatomical specimens.

5. *Scientific supply houses.* The following companies specialize in supplying objects, specimens, and models to schools. Science teachers should write to these firms for free copies of their catalogues:

Biological Supply Co., 1176 Mt. Hope Ave., Rochester, N. Y.

Cambridge Botanical Supply Co., Waverley, Mass.

Carolina Biological Supply Co., Elon College, N. C.

Central Scientific Co., 460 E. Ohio St., Chicago, Ill.; 220 E. 42nd St., N. Y.; 1121 S. Hill St., Los Angeles, Cal.; 79 Amherst St., Boston, Mass.

Chicago Apparatus Co., 1735 N. Ashland Ave., Chicago, Ill.

Clay-Adams Co., 25 East 26th St., New York, N. Y., (models and charts).

Denoyer-Geppert Co., 5235 Ravenswood Ave., Chicago, Ill., (models and charts).

Empire Laboratory Supply Co., 559 West 132nd St., New York.

General Biological Supply House, 761–763 East 69th Place, Chicago, Ill.

Heil Corp., 210 S. Fourth St., St. Louis, Mo.

Kny-Scheerer Corp., 51–52 Twenty-First St., New York, N. Y.

Marine Biological Laboratory, Woods Hole, Mass.

Michigan Biological Supply House, 206 S. First St., Ann Arbor, Michigan.

Millard Heath Co., 400 N. Third St., St. Louis, Mo.

New York Biological Supply Co., 34 Union Square, New York, N. Y.

A. J. Nystrom and Co., 3333 Elston Ave., Chicago, Ill., (charts).

Scientific Supplies Co., 123 Jackson Avenue, Seattle, Wash.

Southern Biological Supply Co., 517 Decatur, New Orleans, La.

South-Western Biological Supply Co., Dallas, Texas.

Standard Scientific Supply Corp., 12 W. 25th St., New York, N. Y.

University Apparatus Co., 2229 McGee Ave., Berkeley, Calif.

Ward's Natural Science Establishment, 302 N. Goodman, Rochester, N. Y.

W. M. Welch Scientific Co., 1515 Sedgwick St., Chicago, Ill.

Western Laboratories, 826 Q Street, Lincoln, Nebraska.

Corporations

Many corporations as a part of their publicity and advertising campaigns, have prepared exhibits which are useful in teaching science. Some of these exhibits which are useful in teaching may be obtained free of charge whereas others are accompanied by a small charge.

Supplementary Reading in Biology

MRS. HELEN D. ORSBORN
South Pasadena Senior High School

That biology should be taught or learned from books alone is unthinkable. But what student, after exploring the inhabitants, large and small, of so restricted an area as the fish-pond, aquarium, or the near-by pool or even the shore of the ocean, if he is so fortunate as to have one at his disposal, will not thrill at a trip (via the printed page) to the Galapagos, or a "Half Mile Down" with William Beebe? When the zoo has offered its bizarre sights and sounds and sent him home with the roar of the lion and the screech of the monkeys ringing in his ears, where is the student who will not journey willingly with the late Martin Johnson to the Lion-country or Congorilla-land? Never has there been such a fund of fascinating, although vicarious adventure open to students of biology as is found in the semi-scientific book-world today. It is a world of pleasure into which every biology teacher should translate the student, in class and out, and should frequently accompany him.

It is not a world for the delectation of only the brilliant student. Even the average and subaverage boy and girl will be fascinated by the personalities and glimpse the adventure of scientific discovery as he reads deKruif's "Microbe Hunters." There are tales for every grade of intelligence and every angle of interest. If routine tasks are to occupy the time and absorb the energy of many of the future citizens who are now in the class-room, some easily available outlet for the normal love of travel, sport and adventure should be afforded them. This may be supplied in some measure by an acquaintance with the world of semi-popularized, scientific books.

Hobbies for leisure time arise from this type of reading. Fishpools and birdhouses, tropical aquaria and camera hunting and a thousand other interests come into view, and many of these form

fascinating avocations which carry over into mature life. Vocations are discovered. Bacteriology and medicine take on new life after reading "Men Against Death," and the story of the vanishing forests of this continent may arouse the desire to make of their restoration a life work. Agriculture takes on new dignity when plant life and breeding are discovered to be subjects of popular interest and of fundamental importance to the nation. Even the much-despised insects are discovered to be foes worthy of respect and their control a challenge to man's ingenuity and scientific skill.

In order to initiate a reading program in connection with biology, a preliminary book list should be supplied the students. To start such a list, consult the school librarian first. Then talk it over with the English department, for science and English can co-ordinate and there may already be books on the English list which are distinctly biological in background. The city library should be the third point of interest. Consult the librarian and the catalogue for available material. If none of these sources proves fruitful, begin with the personal libraries of the students. Exchange of books will soon become common, and in many cases donation of books to the library will follow.

As far as possible make it a student affair. Have the pupils annotate and illustrate the list. Some one among them will prove to be an amateur librarian and will gladly assume the responsibility of keeping the list up-to-date.

The question of book-reports is always debatable. If the student is to acquire profitable reading habits, a simple report seems desirable, while a complicated report is apt to detract from the pleasure of reading. If the report is seemingly designed for correcting and amplifying the list rather than testing the reading ability of the student, a freer reply is given.

Students are urged to express unfavorable as well as favorable opinions of books. An intelligent adverse criticism may be read to the class, and a lively discussion which stimulates interest in the book follows. The popularity of individual books is not stressed although a record may be kept of the books read each year. The wider the exploration in the reading field, the more satisfactory to the student and the instructor. The list should be constantly revised.

Whether this outside reading is to be required or optional, whether credit is to be given or not, are questions which must be answered by local conditions. Students usually want to earn credit, and some need to be given the opportunity to do so. Copies of the list should be available in the class-room and in the school and city libraries.

Books cannot take the place of real life in the biology course, but they can supplement the laboratory and the natural environment of the student, and so lead to a broader outlook and a more intelligent viewpoint on the many biological problems which the world faces today. The establishment of a reading program will be a source of enrichment in the biology course and real pleasure to the student and teacher.

NOTICE TO NEW YORK MEMBERS

Any association member having paid an initial membership fee of twenty-five cents may receive the American Biology Teacher by paying an additional seventy-five cents. Payments may be made to Miss Lucy Orenstein of Evander Childs High School, or direct to the treasury of the N.Y.A.B.T.

Books

HERRICK, FRANCIS HOBART. *"Wild Birds at Home."* New York: D. Appleton-Century Company, 1935. 345 p. $4.00.

This book is a classic of method and observations in bird study. Many years ago Professor Herrick in his work *"Home Life of Wild Birds"* first described and illustrated the results of his use of the tent-blind for the intimate observation and photography of living birds in the field. The present volume represents a "distillation of a life time of study." It comprises the essence of his former published writings and also offers a mass of entirely new data about birds.

In chapter one the author presents a detailed analysis and description of the method he employed in studying the habits of wild birds. His method depends chiefly upon two conditions; (1) The control of the nesting site, and (2) the concealment of the observer. Students of bird life who wish to make observations of their own will find many valuable suggestions and helps in this chapter.

"Wild Birds at Home" deals mainly with the period of mating, nest-building, and the care of the young, the most interesting period of the birds' life cycle and it shows clearly the play of instinct and intelligence in the birds' behavior and habits. It gives the fullest account available of the life of the nest of typical American birds.

The book is illustrated with striking and informative photographs of birds in life and in action. This book brings to the amateur naturalist and the scientific student alike a wealth of authentic information about bird life and an extraordinary adventure in bird lore.

—ELWOOD D. HEISS

THE FIGHT FOR LIFE
PAUL DE KRUIF

Harcourt, Brace & Co., 1938, pp. 342, $3.00.

"The Fight for Life," recently published by Paul de Kruif, author of "Microbe Hunters," tells in a dramatic and readable manner the story of some of the outstanding discoveries along the line of recent medical research.

De Kruif, self-styled a reporter, has gone with Drs. Tucker and Benaron and their crew of interns, medical students and nurses, into the homes of Chicago's poor and has watched them meet and in the largest proportion of recorded cases, successfully overcome, all the dangerous complications that may accompany childbirth. He has watched the work of Charles Armstrong in his search for a substance which would render impervious the delicate nerve-cells in the nose, through which scientists have discovered that the microbes of infantile-paralysis enter the nerve-cells of its victims. He has helped the "health men" in Detroit prove to its citizens that it is economically sound for the city to finance the uncovering by X-ray of the minimal cases of TB, rather than undergo the heavier expenses caused by the inevitable spread of contagion, if the cases are not hospitalized. He has also followed O. C. Wenger from Hot Springs, Ark., to Alabama, Mississippi and Chicago, where he took thousands of blood-tests to track down the spirochetes of syphilis.

In a thrilling and dramatic manner, De Kruif tells the tale of the days of experiment and careful tabulation of the work of researchers in various parts of this country and the world, and of the discovery of sulfanilamide—a simple chemical, which, if properly administered, would do away with child-bed fever, blood-poisoning and gonorrhea. In all directions the health-men are handicapped by lack of funds. De Kruif hopes to make people realize that the health of one is dependent on the health of all and that good health is good economics.

MALCOLM D. CAMPBELL

THE NATIONAL ASSOCIATION OF BIOLOGY TEACHERS
MR. P. K. HOUDEK, *Sec'y-Treas.*
ROBINSON, ILLINOIS

Enclosed please find $1.00 in payment of my membership dues (including subscription to The American Biology Teacher) for the school year ending June, 1939.

Miss ....
NAME Mrs. ....
Mr. ....
ADDRESS ....
(For journal)
SCHOOL ....
POSITION ....
Local biology teachers association of which I am a member ....

Exchange Service

The purpose of this exchange service is to stimulate a friendly exchange of specimens and materials between members of the Association. The journal and Association assume no responsibilty in connection with the exchanges. It is strongly urged that there be no money exchanged. There is no charge for this service to members of the Association.

Listings should be limited to two or three items wanted and available. Listings will be carried in the journal as long as the space available permits. All requests should be sent to the editor-in-chief.

P. K. Houdek, Township High School, Robinson, Illinois. Can supply: Preying Mantids, Coal Fossils, Corn Specimens. Would like to receive: Small Marine Animals, Lubber Grasshoppers, Tropical Epiphytes.

D. F. Miller, Ohio State University, Columbus, Ohio. Can supply: Elm Leaf Beetles (larvae, pupae, adults). Would like to receive: Rat-tail Maggots.

B. Bernarr Vance, Kiser High School, Dayton, Ohio, can supply: praying mantids, fossils, conjugating spirogyra. He would like to receive: marine animals, lubber grasshoppers, and scorpions.

J. A. Trent, State Teachers College, Pittsburg, Kansas, can supply: specimens and seeds of several of the prairie plants. He would like to receive: seeds of Venus' Looking Glass (*Specularia perfoliata*) and specimens of the Resurrection plant (*Selaginella lepidophylla*).

Suggestions and criticisms for the improvement of THE AMERICAN BIOLOGY TEACHER to meet the needs of readers more adequately are always welcome. Your cooperation is essential for the fullest realization of the objectives of this periodical. EDITOR.

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Business correspondence regarding advertising etc. should be addressed to the managing editor.
All other communications should be addressed to the secretary.